INCORPORATING ENVIRONMENTAL PERFORMANCE INDICATORS INTO NATIONAL INCOME ACCOUNTS

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PREFACE

"Incorporating Environmental Performance Indicators into National Income Accounts" was prepared by Ric Careless of Ethos Consulting at the request of the British Columbia Round Table on the Environment and the Economy. It is part of a series of background reports dealing with issues which Round Table considered important to the development of a sustainable development strategy in British Columbia. It is intended to provide information that will assist the dialogue between the Round Table and the public.

The Round Table has not endorsed the report. The information provided and conclusions reached in this document are those of the author.

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EXECUTIVE SUMMARY

Incorporating Environmental Performance Indicators Into National Income Accounts

This background report focuses on the accounting options available for recognizing the significance of natural resource assets and incorporating environmental values into government decision making.

The paper discusses the experience of several countries that have incorporated environmental values into national accounting. Various monetary and non-dollar value accounts are described as are the problems associated with establishing these accounts.

The author proposes eight action points including developing natural resource asset accounts as a first step, using the forest sector for a demonstration project, and then building in environmental quality assets. These action points are designed to promote an environmental accounting program in British Columbia.

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"National income accounts may sound like a pretty obscure subject, of interest to a few academics perhaps and to accountants, a profession that is often the butt of comedians' jokes. But the wrong signals that policy makers have been getting for fifty years are no joke. Instead of just accepting the indicators of progress issued annually by governments and the United Nations, lateral thinkers are saying: Step back, look at what those numbers are ignoring. By giving us a more realistic idea of where we are, environment performance indicators can help us figure out where we - and the planet - are going" Linda Starke: In Signs of Hope

1.0 INTRODUCTION

National income accounts are used to summarize the economic performance of a nation. In particular, the Gross Domestic Product (GDP) is popularly used as the key indicator of economic well-being. However, national income accounting does not incorporate environmental values in calculating assets and depreciation. This is because the national income accounting system developed during the 1940's in the wake of the Depression, when society was focussed on achieving economic recovery and growth. At the time, the impact of human kind on natural systems was not a major concern; as a result, environmental awareness was negligible.

In the 1950's and 1960's, national income accounting was increasingly relied upon for the statistical information that allowed nations to focus their energies into achieving rapid economic expansion. While this growth created wealth previously undreamt off, it also generated massive environmental impacts. The scale of these were such that by the early 1970's, people began to recognize the effects human activities were having on the natural world. It was increasingly clear that if economic growth and environmental impacts were not somehow reconciled, prosperity and ultimately humankind's survival could be at risk. The question was how to do this?

In 1987, the Brundtland Commission suggested an answer. It said:

> "Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." [1]

While this concept of sustainable development has since been widely embraced as a vision to ensure mankind's future, the challenge is to make it real and apply it in today's world. From the standpoint of national income accounting, revisions to current methods are required to ensure that performance indicators measure *both* environmental and economic values.

For as the Bruntland Commission states:

> "The process of economic development must be more soundly based upon the realities of the stock of capital that sustains it.... In all countries, rich or poor, economic development must take full account in its measurements of growth of the improvement or deterioration in the stock of natural resources."[2]

2.0 THE PROBLEM WITH PRESENT NATIONAL ACCOUNTING PROCEDURES

Accounting practises are used by individuals, businesses and governments to keep track of financial and economic performance as well as to gauge our standard of living. The current omission of environmental values in national income accounting can result in seriously misleading conclusions.

Take the example of the Exxon Valdez, recognized as North America's worst oil spill. Under current accounting procedures, no loss to national income would be recorded for the oil that was depleted from in-ground reserves and spilled into the ocean. Neither would the vast negative impacts to Prince William Sound's ecological productivity be recorded. Rather, the catastrophe would be calculated as a net economic gain due to the wages and equipment purchased for spill clean-up!

As another example, consider the case of a farmer who has cut down timber on his farm to build a barn. His personal accounts would reflect the acquisition of a new asset: the barn; and the loss of an old asset: the timber. Still, he would likely consider himself better off since the building is worth more to him than the trees. However, if national accounting procedures were applied, the calculations would look different: The farmer's income and investment would still rise as the barn is built, but now the income accounts would also increase with the cutting of the timber - since the value of the timber would be credited to the logging industry. Most importantly, ***nowhere would the loss of the timber as an asset be recorded***. This discrepancy between the real world and national account recording would worsen if the farmer chose not to re-invest the revenue from timber in a barn, but to consume that revenue instead in the form of a holiday to Whistler. Common sense says that he would be poorer on his return and no longer able to afford a barn. Yet the national accounts would record this situation only as a gain in income, with no loss in wealth.[3]

Clearly, the present national accounting system is flawed due to its inability to identify non-sustainable economic development.

This is because *the present GDP only tracks human-created wealth as assets*. As for natural resource and environmental values, these have traditionally been regarded as 'free gifts of Nature'and as such have not been incorporated into the national accounts balance sheet. There is a simple explanation for this. Economics is based on the concept of scarce resources which are are monetarily valued in a marketplace by people competing for their use. Since environmental resources have historically been regarded as superabundant, the notion of scarcity was not seen to apply to them. Hence they were 'valueless'... free, and thus ignored by the marketplace.

In classic economic theory, price and demand are correlated: the cheaper something is, the greater the demand for that item. By pricing natural ammenities as free, demand can technically be infinite. However, since the environment and its resource are finite, the reality is that demand can eventually outstrip supply. When this happens, environmental carrying capacity is exceeded, economic activity (and society) becomes non-sustainable and ultimately faces collapse.

Such classical if catastrophic economics fails to see natural world values as assets which can depreciate in the course of income generation. This is a legacy from centuries ago when resources did seem limitless, and humanity saw itself divinely instructed to dominate and subdue the earth. Today such an out-dated accounting perspective is dangerously unable to cope with those real world concerns such as ozone depletion, over-cutting of forests and acid rain, etc., that threaten our future.

Therefore, public recognition of environment as a paramount issue in the 1990's is pressing economists and governments to identify means to bring natural world values into the national accounting process. And as Robert Repetto of World Resources Institute indicates, there is a strong environmental incentive for doing this. He says:

> "If depletion of natural resources can no longer masquerade as income growth, governments tempted to engage in environmental deficit financing will be less able to hide behind a reassuring screen of economic indicators. Policies that promote destructive and wasteful uses of natural resources will no longer be justified so easily as necessary for economic growth."[4]

3.0 THE GREENING OF ECONOMICS

3.1 Sustainable Income

A key issue in incorporating environmental concerns into economic indicators focusses on the definition of what income is. Traditionally, national accounts have considered income to be: the sum of monetary earnings accrueing to residents from their participation in economic activity (i.e. National Income = Compensation to Employees + Net Revenues from Property and Entrepreurship + Indirect Taxes) [5] Now with the emerging recognition that environmental resources are not just "free gifts" but impose constraints upon economic activity, the concept of "sustainable income" is being proposed. This is defined as: "the maximum amount of capital that can be consumed in a period while maintaining initial capital and net capital transfers received in that period intact".[6]

3.2 Environmental Assets

Coupled with the idea of sustainable income is the recognition that the term capital must be extended beyond that which is man-made to also include natural (or environmental) assets. The reason for this is obvious: if development is to be sustainable, stocks of both human-created **and** naturally endowed capital must be maintained. This is a crucial concept since it enables environmental attributes such as forests, minerals, wildlife, clean air, etc. to be regarded as assets.

To an economist, an asset is productive capital which can be drawn on to generate income. Traditionally, man-made items have been regarded as assets (e.g. buildings and equipment); these have been written off against the value of production as they depreciated. This accounting practice recognizes that a consumption level maintained by depleting ones stock of capital is not sustainable in the long term. To counter this, a prudent business would typically reinvest sufficient earned income so as to replace or enlarge upon the net value of the businesse's asset base - e.g. in new equipment.

Since natural attributes have not been recognized in the national accounts, environmental assets such as old growth forests have been ignored. So, the costs that have been incurred by society when such values were liquidated have not been recorded and deducted from the GDP. In other words, since environmental resources have not been considered as assets, they have not been able to be depreciated.

(It is salient to note that many resource-based businesses e.g. logging companies, have long recognized the environmental resources which their operations depend on to be assets and as such have incorporated them in their financial accounting. The need is for this approach to also be applied at the national accounting level).

3.3 Depreciation and Investment

The fact is that natural resources are assets. Therefore, if they are to be sustained, they must be managed in a manner similar to man-made resources such that reductions in assets incurred in generating income are compensated for by reinvestment in the environment. A good example is reforestation, which involves the re-investment of some of the income gained from logging to ensure that forest assets continue to be productive.

To ensure sustainability, natural environment re-investment must at least match depletion. Failure to do this means depletion and eventual exhaustion of a nation's natural assets through consumption. Environmental depletion without re-investment means that the present generation draws upon those resources needed by future generations in order to maintain its standard of living. This is what occurs for example, when a fishery or a forest is overharvested.

Therefore, recognizing environmental resources as assets is just the first step in developing better performance indicators for the economy; the next is to find an effective and operational means of recording these assets in the national (and provincial) accounts. This will enable society to chart whether its natural environment activities are sustainable, thereby ensuring that the present generation lives within its means and does not rob from the future.

4.0 TYPES OF ACCOUNTS

4.1 Stock and Flow

Environmental accounting, like traditional economics requires the use of both stock and flow accounts. "Stock accounts" provide a "point in time snapshot" or status report on the state of the environment and its various resources. They are undertaken at periodic intervals.

"Flow accounts" on the other hand, provide information on the changes in environmental assets as a trend over time (usually the intervals between stock account reporting points). For example, a government needs to know how much forest it has at a certain point in time (i.e. stock accounts), as well as the rates at which this resource is being depleted and replenished (flow accounts). From an accounting standpoint, stock accounts relate to balance sheets (or statement of assets) and flow accounts relate to income statements.

4.2 Physical and Monetary Accounts

The methods for recording environmental assets in accounts have been evolving over the past 20 years. This work has focussed on two types of accounts: physical accounts and monetary accounts.

a) **Physical Accounts:** Physical accounts measure environmental resources in terms of quantity (e.g. tons of coal; cubic metres of wood, days of recreation provided) but not quality or monetary value. Physical accounts are useful for situations where monetary valuation of a non-market stock is not possible. (For example, though we know the cubic feet per second of flow in the Frazer River, it would be difficult to put a dollar value on that water flow.) In cases where valuation is possible, physical accounts are the necessary first step in the creation of monetary accounts. Physical accounts are useful for indicating the status and trend associated with an environmental quality resource (see section 4.3 below).

However, physical accounts can't be input directly into economic decision making tools such as the GDP. Since different natural values are recorded in non-standardized units, physical accounts do not offer easy aggregation of different resources (e.g. adding tons of coal to cubic metres of wood does not render a meaningful figure).

b) **Monetary Accounts:** Monetary accounts assign a dollar value to resources. To create a monetary account, a physical account is first compiled. Then the unit monetary value of the resource is determined. Multiplying this unit price by the value renders the monetary account (10 trees @ $3/tree = $30)

The key benefit of monetary accounts is that they permit comparison and combination of accounts for different environmental resources i.e. they provide a *standard of measurement* to enable for example, the comparison of the value of tons of coal with cubic metres of wood. Monetary environmental accounts can be input directly into economic calculations such as the GDP and therefore, into economic decision making. As well, monetary valuation can represent both quality and quantity aspects of an environmental account.

However, monetary valuation is only truly accurate for resources which trade in the marketplace, as do minerals and timber. Non-market resource values such as clean air have to be approximated using more esoteric techniques such as Contingency Valuation Method. The accuracy of such methods can be +- 60% or even only to order of magnitude.[7] In fact, some environmental resource values may not able to be valued at all e.g. oxygen content of lakes. This is especially true in the case of irreplaceable resources - such as the ozone layer - whose worth could be said

to be infinite, since our survival as a species may depend on it. In these latter instances, the only option is to deal with such environmental assets as physical accounts.

Monetary accounts represent a more directly useful level of economic information and supplement rather than replace physical accounts. They should be created in instances where environmental resources can be valued with meaningful accuracy. This better assures that natural asset considerations will be included in economic policy making. In instances where valuation is not possible, it is important that the significance of the physical accounts be conveyed to decision makers.

4.3 Natural Resource and Environmental Quality Accounts

International experience in trying to develop more realistic measures of economic performance suggests that two classes of environmental assets exist: natural resources assets and environmental quality assets. These are discussed below.

a) **Natural Resource Assets:** These assets are environmental values which are associated with recognized industries including:

Asset	Industry
- forests	- forest industry
- sub surface resources	- mining and petroleum
- soil	- agriculture
- water (quantity)	- hydro electric power
- fish	- fishing industry

Accounts for natural resource assets will be the most straightforward to compile given their association with market-oriented economic sectors. Inventory, depletion/replenishment and valuation data often has already been developed in response to industry's need to manage the resource it exploits.

For example, the forest industry has had to gather statistics on timber supplies, harvest rates, restocking and market sales for many years, to plan its economic course . The same is true for agriculture, mining, fishing and other commercial sectors that are based on natural resources. All of these industries have natural resource accounting systems in place for their own planning; however, these systems have not then been incorporated into GDP and national accounting procedures.

Therefore, natural resource asset accounts are available and need only to be organized appropriately to allow their integration into the national accounting process. This is what has been done in the Indonesian example cited below (section 5.4).

b) **Environmental Quality Asset Accounts:** Environmental quality assets can be grouped into land, water, air and biotic components. Values such as air quality, wilderness and biodiversity are examples of these type of assets. Environmental quality assets will be more difficult to compile accounts for since:

1) Gaps in data exist where measurement of values has not occurred. Unlike natural resource sectors, whose related industries have had a vested economic interest in compiling stock and flow statistics, environmental quality measurement has been developed by government to protect public health or common property values. Therefore, direct marketplace incentive has not existed to encourage the compilation of these accounts.

2) Environmental quality values have not generally been sold in a marketplace, as natural resource assets have. Therefore, valuation will be more difficult, imprecise and sometimes impossible.

3) Many environmental quality values have only recently been perceived by society (and many new ones are yet to be discovered.) Therefore, data or measuring capability may be non-existent for these values.

Therefore the preferred approach to evaluating environmental quality assets is to do the best possible with the available data - in a time and cost effective manner - with the intent of improving these accounts as knowledge and data accumulates. Where possible, data should be recorded in a form that will render it readily usable for national accounting purposes. Attention should be directed to improving the monetary valuation of these accounts. Environmental quality assets which are not easily valued should be recorded using environmental quality indicators.

5.0 THE INTERNATIONAL EXPERIENCE TO DATE

Attempts to incorporate environmental values into national accounting were initiated in the early 1970's when ecological consciousness first emerged. The pioneering work has been done by Japan (1973), Norway (1974), France (1986), Indonesia (1989), the USA (ongoing) and the United Nations (ongoing). The approach taken in these locations has evolved over time as understanding of the environmental issues and accounting tools have developed.

5.1 Japan - Pollution Abatement Monetary Accounting

Due to the pace of industrialization during the 1960's, pollution impacts became a major problem in Japan. As a result, this country took an early lead in environmental accounting by creating a measure of Net National Welfare (NNW) that was applied

Fig. 1 JAPANESE ENVIRONMENTAL ACCOUNTING

Adjustments to GNP in Japan to obtain net national welfare (unit: billion yen, 1970 prices)

Fiscal year	*1955*	*1960*	*1965*	*1970*	*1975*	*1980*	*1985*
NNW government expenditure	1,199	1,374	2,254	2,988	3,865	4,283	4,887
NNW personal consumption	10,427	14,706	22,168	32,097	43,003	54,009	61,700
Government capital service	62	99	169	317	559	756	1,103
Personal durable goods service	91	195	755	2,342	4,187	5,270	6,813
Leisure time	4,871	6,098	7,325	10,509	16,759	18,961	20,816
Extra-market activities	1,876	2,388	4,068	7,213	12,707	12,571	13,079
Environmental pollution (deduction)	–38	–1,037	–3,735	–6,805	–5,729	–3,932	–3,103
Loss due to urbanization (deduction)	–452	–695	–889	–1,113	–1,119	–1,272	–1,514
NNW	18,036	23,128	32,116	47,548	74,231	90,646	103,781
GNP	17,268	26,183	41,591	72,144	93,260	118,105	143,387

Source: BLUEPRINT FOR A GREEN ECONOMY

Fig. 2 NORWEGIAN ENVIRONMENTAL ACCOUNTING

2a) Classification of resources in the Norwegian accounting system

Resource	*Physical Classification*
Material	Minerals: minerals, hydrocarbons, stone gravel and sand.
	Biological resources: in the air, water, on land and in the ground.
	Inflowing resources: solar radiation, hydrological cycle, wind, ocean currents.
Environmental	Status resources: air, water, soil and space.

2b) Land use accounts in Norway (hectares)

Period	*Land use after development*	*Land developed*			
		Total	Agri-culture	Forest	Other unbuilt
1955–65	Total	17322	6294	5785	5243
	Residential	10852	4078	4085	2689
	Other built-up	6470	2216	1700	2554
1965–75	Total	21531	6842	8462	6227
	Residential	12771	3989	5789	2993
	Other built-up	8760	2853	2673	3234

Emission Accounts in Norway (Tonnes)

	Sulphur dioxide		Nitrogen oxide		Carbon monoxide	
	1980	*1982*	*1980*	*1982*	*1980*	*1982*
Total	140	112	134	120	582	643
Agriculture	2	2	2	3	19	21
Manufacturing	108	84	30	20	34	68
Transport	11	11	38	37	35	40
Households	6	5	28	29	390	407

as a correction factor to the national income accounts. The NNW considered - among other things - environmental values such as: water contamination, air pollution and waste disposal. The Japanese approach was to value the cost entailed to diminish existing pollution/waste levels to targeted quality standards. The costs of achieving such clean up were then deducted from the GDP. (see Figure 1)

Japan's initiative dealt only with pollution abatement and was geared to an arbitrary choice of standards. As such it reflected the state of environmental concern in that country at the time. Today such an environmental accounting strategy would probably be considered too limited. Nevertheless, Japan did show leadership in incorporating natural world values into national economic accounting. And dramatic results occurred: the government enacted policies which for example, by 1975 had reduced atmospheric sulphur dioxide by 50%.[8]

5.2 Norway - Natural Resource Physical Accounting

Norway was the first country to devise a comprehensive set of environmental accounts. The Norwegian thrust was to establish a range of physical accounts which provided both stock and flow statistics. (see Figure 2) The accounts were divided into two broad classes:

- materials resources - these accounts recorded natural resources associated with existing industrial sectors e.g. forests; subsurface minerals; and

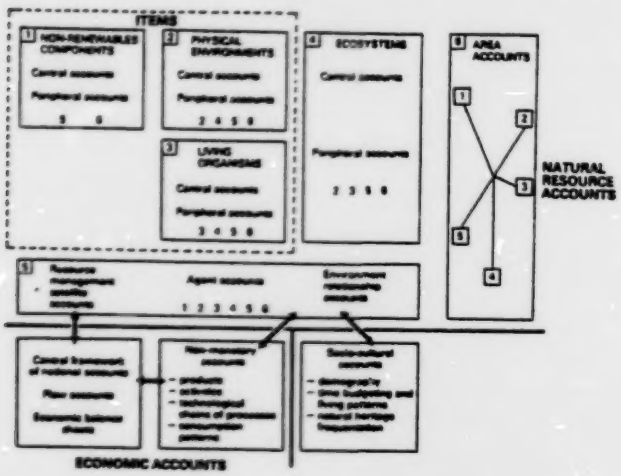
- environmental resources - these incorporated emission accounts dealing with waste & pollution issues; and state accounts that described the state of, and changes in the environment.

The Norwegian program reflected a different perception of environment than Japan's. While pollution control was the Japanese focus, the area most effectively dealt with by the Norwegians related to the materials - or natural resources accounts. Norway's experience as a small country reliant upon fisheries, forests and most recently oil, doubtless spawned an early awareness that such environmental stocks must be accounted for to ensure future well-being.

Not surprisingly, the Norwegians had the most success in defining their natural resources accounts. Non-renewable resources (e.g. minerals) were categorized into: developed reserves, undeveloped reserves, new fields, revaluation (i.e. when previous estimates are revised) and extraction. Renewable resources accounts (e.g. fish) were categorized into: reserves, recruitment (i.e. new additions to stock (through enhancement; intensive management; etc)), revaluation, extraction and natural mortality.

Fig. 3 FRENCH ENVIRONMENTAL ACCOUNTING SYSTEM

Structure of the natural resource accounts system in France



KEY: 1 — Stock at the beginning of the period
2 — Upward adjustment in known reserves
3 — Downward adjustment in known reserves
4 — Gross natural increase
5 — Natural depletion
6 — Increase due to resource development
7 — Depletion due to withdrawal
8 — Imports

Central account of water in France (billions of cubic meters)

Beginning of period						End of period					
Sub-items	I	II	III	IV	Total	Sub-items	I	II	III	IV	Total
Long term						*Long term*					
1. Snow and glaciers	130				130	1. Snow and glaciers	150				150
Groundwaters						*Groundwaters*					
2. Ground aquifiers	300	200	100		600	2. Ground aquifiers	350	150	70	20	585
3. Alluvial aquifiers	100	250	300	50	709	3. Alluvial aquifiers	90	240	320	73	723
3. Confined aquifiers	200				200	3. Confined aquifiers	200				200
Medium term						*Medium term*					
5. Lakes and ponds	10	15	15		30	5. Lakes and ponds	15	15	10		30
6. Dams		8			8	6. Dams		8			8
Short term						*Short term*					
7. Rivers	21	23	53	68	165	7. Rivers	20	25	36	60	133
11. Human activities	2				2	11. Human activities				2	2
						12. External					13
TOTAL					1844	TOTAL					1844

Source: Blueprint for a Green Economy

By contrast, the environmental accounts were less clearly defined and proved of limited utility.

The prime shortcoming of the Norwegian approach was that recording was limited to physical accounts, with each resource being calculated in its own units and not monetarily valued. This prevented direct input of data into national economic calculations. As a result, the impact on Norwegian decisionmakers has been limited although this pioneering accounting exercise did increased overall awareness of environmental values.[9]

5.3 France: A Focus on Inter-resource Linkage and Process

In the mid-1980's, France developed an environmental accounting system, similar to but more comprehensive and ambitious than Norway's. Like Norway, the French exercise focussed on physical accounts though some valuation was also been done. This valuation was limited to describing administrative, maintenance and development costs associated with particular environmental values rather than trying to establish a monetary worth for the environmental resources themselves.

The French system defines the following categories:

- central accounts that describe the stock and flow of environmental resources (in physical units);
- peripheral accounts that show relationships between one resource and another, and also between the resource and human activities;
- agent accounts that describe the flows between a resource and a physical activity (e.g. forests and logging) in terms of physical quantities, as well as the expenditures approved for its maintenance, supervision or development.

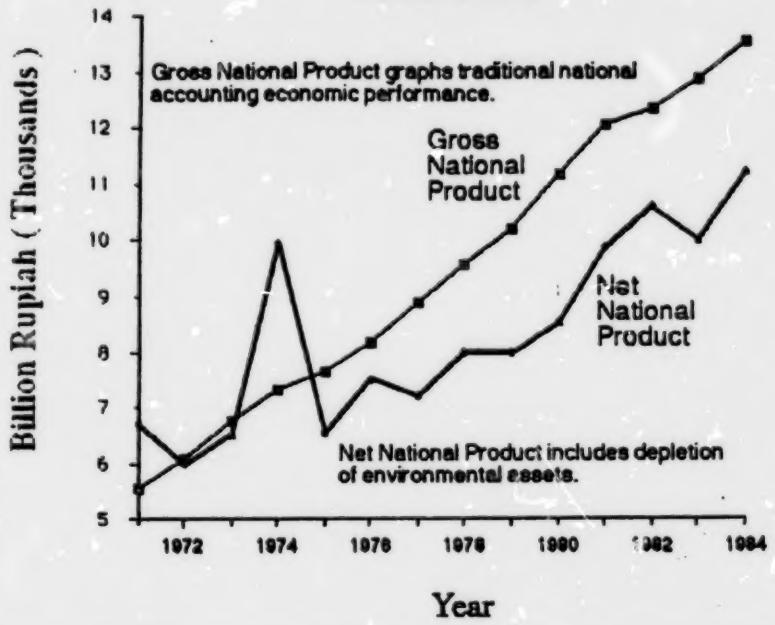
Unlike its predecessors, the French system attempts to show linkages between environmental values but seems more administratively than ecologically oriented. (see Figure 3) It is an intricate accounting system that does not seem to be easily applied to decisionmaking. As well, like the Norwegian program, the French emphasis on physical rather than monetary accounts does not enable direct input to the economic national accounts. To date, the utility of the French system seems unproven.

5.4 Indonesia: Natural Resources Monetary Accounting

Recent work in a study by the Washington-based World Resources Institute has demonstrated how natural resources monetary accounting can be applied to a country like Indonesia. The study argues for the need to input environmental values directly into economic national accounting and therefore takes the perspective

Fig. 4 INDONESIAN ENVIRONMENTAL ACCOUNTING APPROACH

4a) Environmental Performance Indicators for Indonesia



4b) Comparison of GDP and "NDP" In 1973 Rupiah (billions)

Year	GDP[a]	Net Change in Natural Resource Sectors[b] Petroleum	Forestry	Soil	Net Change	NDP
1971	5,545	1,527	-312	-89	1,126	6,671
1972	6,067	337	-354	-83	-100	5,967
1973	6,753	407	-591	-95	-279	6,474
1974	7,296	3,228	-533	-90	2,605	9,901
1975	7,631	-787	-249	-85	-1,121	6,510
1976	8,156	-187	-423	-74	-684	7,472
1977	8,882	-1,225	-405	-81	-1,711	7,171
1978	9,567	-1,117	-401	-89	-1,607	7,960
1979	10,165	-1,200	-946	-73	-2,219	7,946
1980	11,169	-1,633	-965	-65	-2,663	8,506
1981	12,055	-1,552	-595	-68	-2,215	9,840
1982	12,325	-1,158	-551	-55	-1,764	10,561
1983	12,842	-1,825	-974	-71	-2,870	9,972
1984	13,520	-1,765	-493	-76	-2,334	11,186
Average Annual Growth	7.1%					4.0%

a. In constant 1973 Rupiah, billions. From the Indonesian Central Bureau of Statistics.
b. The flow of resources in each sector is elaborated in the sections on the specific resource later in the text. Positive numbers imply a growth in the physical reserves of that resource during the year.

Source: [illegible] Resources

INDONESIAN ENVIRONMENTAL ACCOUNTING (cont)

4c) Example of Resource Inclusive National Acounting System

	Physical Units	Unit Value	Value ($)	Basis of Calculation
Opening Stock	100	1.00	100	
Additions:				
Discoveries	20	1.60	32	
Revisions (Net)	(30)	1.60	(48)	
Extensions	15	1.60	24	
Growth*	0	1.60	0	
Reproduction*	0	1.60	0	
Reductions:				
Production	(20)	1.60	(32)	
Deforestation*	0	1.60	0	
Degradation*	0	1.60	0	
Net Change	(15)	1.60	(24)	
Revaluations:				
Opening Stock	–	–	200	100 x (3.00–1.00)
Transactions	–	–	(21)	15 x (3.00–1.60)
Closing Stock	85	3.00	255	

Note: Example of a natural resource account as it might appear in national economic accounts. The resource unit value (based on international commodity prices less factor costs incurred in extraction or production) is assumed to be $1.00 at the beginning of the year, $3.00 at the end of the year, and to average $1.60 during the year.

The total increase in the value of the resource over the period shown is equal to $155 ($255–$100). The methodology recommended in this paper would result in a downward adjustment to net national product of ($24). The remaining net change in total value of $179 ($155 + $24 or $200 – $21) would be recorded in a revaluation reserve and have no impact on income of the current period.

Items marked * are specific to forest resources; all other categories are applicable to subsoil minerals, e.g., oil and gas.

4d) Indonesian Forestry Accounts

PHYSICAL ACCOUNTS (million cubic meters)	1980	1981	1982	1983	1984
Opening Stock	24,565.0	24,440.0	24,334.5	24,238.8	24,001.3
Additions					
Growth	51.9	51.9	51.9	51.9	51.9
Reforestation	22.1	24.2	26.3	29.6	35.3
Reductions					
Harvesting	25.2	16.0	13.4	15.2	16.0
Deforestation	110.0	120.0	120.0	120.0	120.0
Logging Damage	49.8	31.6	26.5	30.0	31.6
Fire Damage	14.0	14.0	14.0	153.8[b]	14.0
Net Change	–125.0	–105.5	–95.7	–237.5	–94.4
Closing Stock	24,440.0	24,334.5	24,238.8	24,001.3	23,906.9
UNIT VALUES (US$/m³)					
FOB Export Price	106.93	95.84	100.59	78.75	93.15
Costs	34.24	37.93	41.00	43.31	51.23
Primary Rent	72.69	57.91	59.59	35.44	41.92
Secondary Rent	36.34	28.95	29.79	17.72	20.96
MONETARY ACCOUNTS (US$ millions)					
Opening Stock	961,474.0	1,256,046.9	996,266.8	1,020,959.6	601,049.0
Additions					
Growth	1,886.3	1,502.8	1,546.4	919.7	1,087.8
Reforestation	0	0	0	0	0
Reductions					
Harvesting	1,831.8	926.6	798.5	538.7	670.7
Deforestation	3,998.0	3,474.6	3,575.4	2,126.4	2,515.2
Logging Damage	1,810.0	915.0	789.6	531.6	662.3
Fire Damage	508.8	405.4	417.1	3,870.9	293.4
Net Change	–6,262.3	–4,218.8	–4,034.2	–6,148.3	–3,053.8
Revaluation*	300,835.2	–255,561.3	28,727.0	–413,762.7	109,775.0
Closing Stock	1,256,046.9	996,266.8	1,020,959.6	601,049.0	707,770.2

b. The value for fire damage in 1983 is made up entirely of estimates for the Kalimantan fire, assuming mortality rates of 25%.

Source: Wasted Resources

that natural resources should be dealt with as monetarily-valued assets.[10]

This study focusses on three natural resource areas: forests, soil and petroleum. The study design therefore has a narrow focus, especially when compared to the range of environmental values addressed in the French and Norwegian programs. The benefit of such focus however, is that it has enabled some of the highest priority environmental resource values to be compiled and input into the national accounting process.

The Indonesian study is especially relevant to British Columbia since both economies are heavily dependent on natural resources such as forests, soils and minerals. Given that the Indonesian methodology is straight-forward and applicable to decisionmaking, it is described in greater detail below.

The Indonesian study method starts by compiling stock and flow physical accounts for each of the three resource sectors. Stock accounts are based on present inventory volume assessments using standard measures (e.g. cubic meters for forests). Flow accounts are compiled for the following factors:

a) for renewable resources (e.g. forests):

- production (i.e. harvesting)
- deforestation (permanent loss of forest cover to other land uses)
- degradation (i.e. short term loss of productivity due to fire, insects, soil loss, etc)[11]
- growth (annual increment)
- reproduction (e.g. rate of replenishment)

b) for non-renewable resources (e.g. oil):

- production
- discoveries (new reserves)
- revisions (extraction related: downwards due to depletion or upwards due to improved technical efficiency)[12]
- extensions (increase to known reserves due to improved inventory information)

This data is all derived from statistics which have been compiled by government in the administration of natural resources-based industries.

To create an account for forestry therefore, the opening stock is recorded in m^3. Flow changes over a given period from items such as harvesting and reforestation are then added/deducted from the opening stock to produce the closing stock.

Next, the physical accounts are converted to monetary accounts using net price valuation (i.e. current revenues less current

production costs) for stock levels and changes. Net changes in the values of stocks therefore result from current year additions (discoveries, net revisions, extensions, growth, reproduction), less deductions (degradation, deforestation or depletion), plus any price changes of the resource during the year.

Price changes in the value of natural resources can fluctuate significantly (as has happened with oil in late 1990) thereby masking the significance of stock changes due to resource depletion/addition. To ensure such skewing is avoided, the net physical change in natural resource stocks is valued at the average net price prevailing during the accounting period.[13] This figure is then applied against the Gross National Product to produce a Net National Product (NNP) which incorporates natural resources as well as man-made assets.

When this method was applied to the forest, soil and oil resources of Indonesia, the end result was a downward revision of country's economic growth from the GNP figure of 7%, to the natural resource adjusted NNP figure of 4% (for the period 1971-84). What this means is that when depletion of Indonesia's natural resources are included in the national accounts, the economy grew only about half as fast as the traditional GNP indicator would suggest. (see Figure 4)

In other words, some 3-4% of economic growth, as measured by GNP, during that period was generated by the depletion of natural assets. Furthermore, the income associated with this asset depletion was "consumed" rather than reinvested and converted into other forms of assets such as new manufacturing capability, buildings etc..

5.5 United States: A Glimpse Towards Future Methods for Comprehensive Socio/Enviro/Economic Accounting

A variety of attempts to revise the national accounts have been proposed by private interests and academics in the USA. To date no government sponsored changes have been attempted.

One especially sophisticated and ambitious model for national accounting is proposed by Daly and Cobb (1989)[14]. A departure from traditional national accounting approaches, it attempts to move toward a more realistic measure of the actual economic welfare or well being of ordinary citizens, based on both social equity and environmental factors.

The proposed model incorporates the natural resource asset depletion methods utilized in the Indonesian study, as well as a number of other environmental considerations including: air, water and noise pollution costs, biological productivity, loss of wetlands and valued habitats, etc.. As well, social cost/benefit factors related to health, education, urbanization, foreign investment, automotive vehicle use and more are considered. This

wide variety of factors are then combined to yield an Index of Sustainable Economic Welfare (ISEW) .

According to the authors, a comparision of per capita GDP and per capita ISEW demonstrates what many people in society intuitively feel: that when social/environmental/economic factors are comprehensively considered, the welfare of ordinary people has increased far more slowly than traditional national accounting performance indicators such as the GDP would suggest.

Though Daly and Cobb's model and calculations are complex and often based on questionable data, their method does give insight as to the possible future for performance indicators and national accounting. For the present however, the approach remains untried in the real world and goes well beyond what seems achievable in B.C. in the foreseeable future.

5.6 United Nations

The United Nations has long promoted national income accounting as a means for standardizing economic reporting amongst nations. This has enabled the UN to make comparisons between nations, which is an important factor for this world body when it attempts to direct aid and other programs. Therefore the UN has periodically (1954 and 1968) published an updated System of National Accounts (SNA) as a template for national economic planners. The latest revision is planned for 1991.

In this edition the UN is proposing that natural capital accounts be recorded (in addition to the presently compiled man-made capital values). However, the UN is presently recommending that these be kept separate from and unintegrated with the national income accounts. The UN calls for such "satellite accounts" as an interim measure while environmental resource accounting methods mature.[15]

The following organization of accounts is proposed:

GDP is the sum of:
- compensation to employees
- operating surplus from property and entrepreneurship
- consumption of fixed capital
- indirect taxes, less subsidies

NDP1 (i.e. the conventional NDP) deducts:
- consumption of fixed capital

NDP2 further deducts:
- depletion and degradation of environmental assets

NDP3 further deducts:
- expenditures on environmental protection and restoration [16]

5.7 Canada

Though the federal government has commissioned studies related to environmental performance indicators, no operational attempts at revised accounts have yet been attempted in Canada. Discussions between Round Table members across the country indicate however, a high degree of interest in moving in this direction.[17]

6.0 STATE OF THE ENVIRONMENT REPORTS

6.1 What is State of the Environment Reporting?

With the recent resurgence in environmental concern, interest has developed for governments to produce State of the Environment reports (SOE). A green equivalent of the U.S. State of the Union Report, at periodic intervals an SOE provides government and society with a status report on:

- environmental stocks and trends;
- the natural processes and human activities affecting those conditions and trends;
- the management program for responding to environmental concerns.

Although a number of models have been developed around the world, SOE reports can be categorized into 3 general types:

a) those which emphasize environmental quality indicators (e.g. air quality indices);
b) those which deal with natural resource sectoral performance indicators (e.g. forestry);
c) those which are accounting oriented.[18]

Given past international experience with environmental accounting, it can be argued that the ideal SOE should contain elements of all three approaches, i.e.:

- natural resources sectoral performance should be reported in physical and (to the extent possible) monetary account terms;

- non-market environmental quality values should be described in physical terms and compiled into easily understood, meaningful environmental quality indicators.

6.2 Canadian SOE Experience

To date, SOE reporting in Canada has been undertaken by the following governments:[19]

- the Federal Government (Environment Canada & Statistics Canada) issued its first SOE in 1986. The need to improve on the content and compilation of subsequent SOE's resulted in a SOE reporting system being mandated under the 1988 Environmental Protection Act. The federal reporting schedule is on a 5 year basis with the next report planned for 1991.

- Manitoba established SOE reporting in its 1988 Environment Act. The first report is scheduled for 1991 and thereafter at two year intervals. It will be prepared by an interagency Technical Advisory Committee of Cabinet.

- in Quebec, the Environment Ministry produced an initial SOE in 1988. The next is planned for 1992.

- British Columbia intends to produce an SOE by mid-1991. It is proposed that the Ministry of Environment will prepare the report for and in conjunction with the Round Table on Environment and Economy. Details for the B.C. SOE (e.g. reporting schedule) have yet to be finalized.

Information from the various governments reveals the process to be in its infancy. Issues such as: report contents; style (e.g. the level of statistical data to be presented), target audiences and frequency of publication are still under discussion.

From the standpoint of this study, the key issue is that SOE reporting should integrate with and support the information requirements of an environmental accounting process. Since SOE reporting requires the systematic and periodic compilation of environmental data, it could also be the vehicle for consolidating the needed accounts statistics. This would not only be efficient, but would link the environmental accounting and reporting functions of government.

7.0 PROVINCIAL ACCOUNTING FOR ENVIRONMENTAL ASSETS

7.1 Why Should B.C. Get Involved?

Although the term used throughout this report is "national " income accounting, there are two key reasons why environmental accounting should be considered at the provincial level in B.C.:

1. In Canada, jurisdiction over most natural resources is vested with the provinces under the BNA Act. Therefore B.C. has direct responsibility for most environmental resources.

2. Much of British Columbia's economy is directly based on environmental values, e.g. its forests, agricultural and tourism lands, minerals, fish, wildlife, etc.. Only by incorporating these values into the Provincial accounting process as natural assets will it be possible to chart a proper course for the province and ensure the economic and environmental sustainability of the province's future.

7.2 Objectives for a B.C. Environmental Accounting System

Having said this, the objectives of a B.C. environmental accounting system must be determined. The most significant ones would seem to be:

a) to incorporate environmental values in government economic decisions and policy making so as to facilitate sustainable development;

b) to provide physical and monetary accounts information to assist in public recognition of the significance of natural environment assets.

7.3 Target Audiences

These objectives suggest that the likely target audiences for a revised accounting system include government decisionmakers (both political and bureaucratic); business decision makers, opinion leaders in the environmental movement and the general public.

It may seem that the most critical audience of these is government, since public environmental concern often seems to be in advance of the decisionmakers. Nevertheless, environmental quality is an essential, complex and long-term issue, so that keeping the public informed will be key. Since economics plays a crucial role in shaping B.C. societal attitudes, it's important that environmental values be conveyed to the public in economic terms.

Therefore, the mix of target audiences suggests that the output of the environmental accounting process must be both rigorous enough to allow rational decision making on complex problems, but also be presented in a form that can be readily understood by a wide audience. This is not an easy assignment. However, if the focus of the B.C. program is directed to monetarily-valued natural resource accounts (in the manner done for Indonesia) as well as the use of quantified indices - or indicators - for non-market environmental quality assets, this task should be possible.

8.0 A SUGGESTED ACTION FOR BRITISH COLUMBIA

An action plan is proposed below to effectively and efficiently facilitate an environmental accounting program in B.C.:

a) Focus First on Natural Resources Assets Accounts:

B.C. should place primary emphasis on integrating natural resource assets accounts into the Provincial Accounting System for the sectors of: forestry, mining/petroleum, agriculture, fish, wildlife and electricity. Natural resources monetary accounting is afforded top priority for several reasons:

a) data for natural resource assets is already compiled regularly by government agencies. Hence, of all environmental values, natural resources accounts can most readily be input to the Provincial Accounts and thereby most immediately contribute to economic decisionmaking;

b) natural resources are among B.C.'s primary environmental values and the industries associated with them play a key role in the provincial economy;

c) given their scale of operations, B.C.'s natural resource industries can dramatically affect the depletion of environmental assets.

b) Use the Forest Sector for a Demonstration Project:

Of the various natural resource assets, premier attention should be applied to the forest sector because:

- forest extraction is the largest natural resource based industry in the province and the largest revenue generator;

- inventory, depletion/replenishment and valuation information is best developed for this sector and can most readily be included in the Provincial Accounts;

- the forest industry uses the largest portion of the B.C. land base and most influences other land users including: tourism, fish, wildlife, agriculture, water resources, recreation, etc.;

- the sustainability of the forest industry is crucial to community stability and provincial economic health;

- forest extraction affects non-resource environmental quality values including air pollution, water pollution, biodiversity, wilderness, etc..

- forest products are regularly valued in the market place; therefore assigning a dollar value is comparatively straight forward.

Since the opportunity for, and consequences of integrating forestry into the Provincial Accounting System are substantial, it is recommended that a Forestry Accounts Demonstration Project be undertaken modelled along the lines of the one done for Indonesia. This project could be co-sponsored by the Round Table and the Forestry Commission and possibly carried out under the auspices of the Institute for Sustainable Development (to ensure that the data and process is considered impartial).

c) Link to Environmental Quality Resource Accounts:

After natural resource assets, secondary priority should be on recording environmental quality assets where monitoring data exists - e.g. air and water quality - with physical, and where meaningful, monetary accounts. Focus should also be on filling in gaps in the present measuring/monitoring capabilities.

d) Extend Environmental Quality Assets Accounts:

Final priority should be placed on developing measuring methods, data and accounts for environmental quality resources which are currently perceived but unrecorded: e.g. biodiversity; wilderness, etc..

e) Integrate the State of the Environment Reporting and the Environmental Assets Accounting Process:

B.C.'s State of the Environment (SOE) reporting capability is yet in its formative stage. To maximize effectiveness and avoid duplication of effort, it should be integrated with and support the environmental assets accounting process. This means the SOE data should be appropriately compiled to provide data in the form of environmental quality resources physical and (where possible) monetary accounts. Both stock and flow data should be compiled.

f) Keep the Accounting Method Simple:

Reviewing the experience of nations which have attempted to input environmental values into the national accounts, it seems that straight-forward approaches which incorporate monetary valuation will be of the most use to, and most used by decisionmakers. For example, Japan's pollution accounting led to dramatic results, whereas the more convoluted French system has not. The Indonesian approach seems to handle natural resource values well and would be especially applicable to B.C.. (However even this method will only be of value if it is understandable in concept at least, by the media and public.)

g) Use Environmental Indices for Environmental Quality Assets Which Are Not Ammenable to Valuation:

The methods for valuing non-market goods and services can be so convoluted and involve such unacceptable margins of error as to render meaningless results. Hence expending too much effort to value certain non-market environmental quality assets will often be counterproductive. The significance of such items may best be conveyed through the use of non-economic, but quantified environmental quality indices.

Therefore it is suggested that the SOE process be used to determine those environmental quality assets which are, and are not suited to monetary valuation. Those assets that are difficult to monetize should remain in the domain of SOE reporting, the others can be moved forward into the accounting process. Any data that goes forward to decision makers however, should include clear discussions of what factors have been included and what have not been included in the accounting process.

h) Undertake a Site Specific, Environmental Index Demonstration Project

In order to determine the complexity and feasibility of developing an index for non-monetary environmental assets, it is suggested that a pilot project be undertaken for a compact, ecologically defined area: e.g. a community-related watershed. Due to its smaller geographic scale, such a demonstration would function as a "laboratory" to ascertain the key factors which should be built into such an index, and the relative ease and cost of gathering the needed data.

Since this demonstration would link an environmental quality index to a geographical area - perhaps using a computerized Geographic Information System (GIS) - it would clarify the role that could be played by communities and local citizens in the development of environmental performance indicators.

i) Environmental Accounting Responsibilities:

It is proposed that a permanent Provincial Accounts Task Force be struck comprised of representatives from at least the Ministries of Environment, and Finance & Corporate Relations, as well as possibly Economic Development, Forestry and others. Building in a public advisory capacity to this Task Force that involved of representatives from the provincial universities, major banking institutions, major industrial sectors and respected environmental interests would be beneficial. The Task Force would report to the Sustainable Development Committee of Cabinet, after consultation with the Round Table on the Environment and Economy. The proposed Institute for Sustainable Development could offer research support to the Task Force .

NOTES AND SOURCES

1. World Commission on Environment and Development, Our Common Future,(1987), p.8

2. Ibid., p.10.

3. Examples derived from: Robert Repetto, et al.,op cit. Wasting Assets: Natural Resources in the National Income Accounts, World Resources Institute. Washington, 1989.

4. Quoted in: Signs of Hope: Working Towards Our Common Future,(Linda Starke), Oxford University Press. Oxford,1990.

5. Joseph R. Potvin, Economic-Environmental Accounts: A Conspectus on Current Developments, (1989), p. 15.

6. This is proposed by a review of the System of National Accounts by a joint task force of the UN, World Bank, and OECD. see: Report of the Joint UNEP/World Bank Expert Meeting on Environmental Accounting and the System of National Accounts, Paris, Nov. 1988.

7. David Pearce, Blueprint for a Green GNP. Earthscan. London, 1989. p.87.

8. Edwin O. Reischauer, The Japanese Today. Belknap. Harvard, 1988. p. 288.

9. It is interesting to note that in B.C. we have a higher value added, Japanese-style economy developing in the lower mainland while the remainder of the province continues with a resource dependent, low value added Norwegian-style of economy. The implication is that a combination of Japanese environmental quality and Norwegian natural resource accounting procedures will be required for B.C..

10. Robert Repetto, et al.,op cit.

11. Ideally, soil loss should have a category of its own since it represents a permanent rather than short term loss of productivity. This was not done in the Indonesian study.

12. Revisions should also include land base reductions from natural resources for proven resources situated in national parks, urban areas etc, where production is precluded.

13. This approach is similar to that applied by accounting conventions for man-made capital assets which value assets at 'book value' rather than replacement costs, so as to keep unrealized capital gains/losses out of the current income accounts. In the case of the Indonesian study, this is done by recording unrealized capital gains/losses for existing natural

resource inventories in a revaluation reserve which has no effect on the current period's income.

To do this, at the end of each accounting period the physical units comprising the opening balance of natural resources stocks are revalued at the net price prevailing at the end of the end of the period. The difference in this figure and the average net price for the period is recorded in the revaluation reserve as an unrealized capital gain/loss.

14. Herman Daly and John B. Cobb Jr., Measures of Sustainable Economic Welfare. 1989.

15. Op cit. Report of the Joint UNEP/World Bank Expert Meeting. Paris, 1988

16. op. cit., Potvin, p 11

17. Bob Jamieson, personal communication.

18. Regional Consulting Ltd., Preliminary Research for the 1991 State of the Environment Report; a study undertaken for B.C. Ministry of Environment, August 1990.

19. Westwater Research Centre, Minutes of: National Workshop on State of the Environment Reporting. Victoria; October, 1989.